

# NASA TECH BRIEF

## *Lyndon B. Johnson Space Center*



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### Insulated ECG Electrodes

#### The problem:

A silver-silver chloride electrode is commonly used with present electrocardiogram (ECG) systems. It is attached to human skin with an electrolyte paste which provides a low resistance path from the skin to the

electrode. This method imposes several disadvantages. When the paste is left on over an extended period, it will dry and increase the skin-to-electrode resistance. Bacteria or fungi may then grow under the electrode and cause skin irritation. In addition, the shifting potential at the electrode-skin interface causes a baseline drift in the recording and distorts the readings. Readings are also distorted when the subject moves.

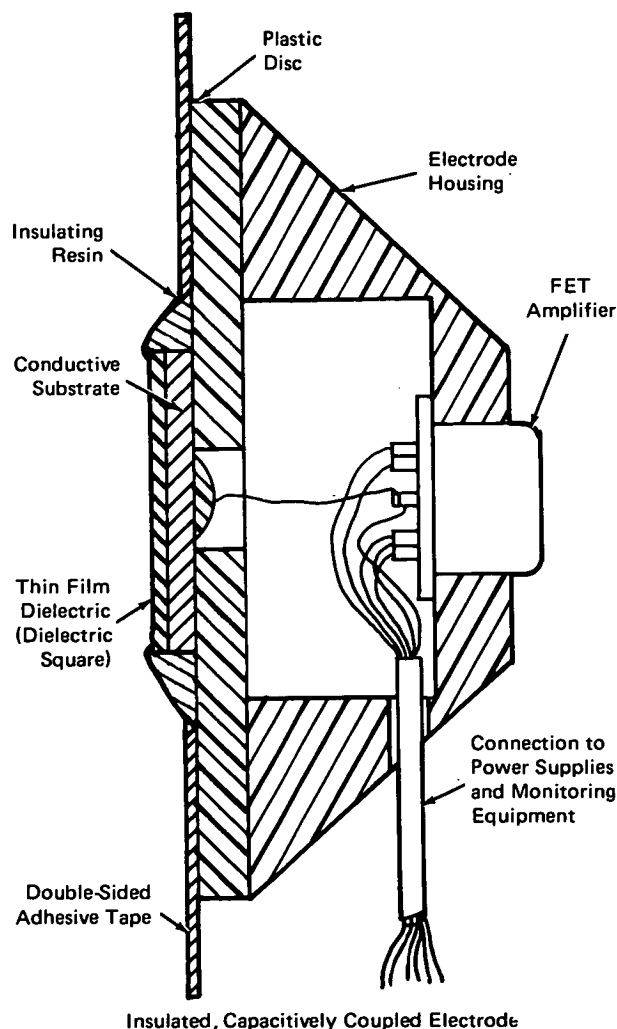
#### The solution:

An insulated, capacitively coupled electrode does not require electrolyte paste for attachment, thereby eliminating all of the above-mentioned problems.

#### How it's done:

Compatibility of the electrode with existing ECG systems is provided by a high-performance, FET (field-effect transistor) electrode amplifier connected in a unity-gain configuration to function as an impedance transformer. Thus, the high source-impedance of the capacitively coupled electrode is made compatible with systems using paste-type electrolytes which have a low impedance.

The electrode (see figure) is formed by depositing a thin film dielectric onto a conductive substrate by radio-frequency sputtering, which mechanically bonds the dielectric material to the substrate. A high-performance, FET electrode amplifier is electrically connected to the dielectric square and is mounted in a plastic electrode housing. The dielectric is fastened to a plastic disc with an insulating resin, which precludes possible contact between the skin and the substrate, thus avoiding any skin-to-substrate shorts. The dielectric square is electrically connected to the amplifier by a wire conductor. Wires which extend through an opening in the side of the housing provide electrical connections to the power supplies and monitoring equipment.



(continued overleaf)

The electrode is applied to the skin with double-sided adhesive tape. The dielectric material is thus held closely against the skin surface to produce a capacitor configuration in which the skin acts as one plate of the capacitor and the substrate as the other. Because of its capacitive action, the electrode inherently blocks dc drift at the electrode-skin interface.

Other features of the electrode include a wide range of nontoxic material that may be employed for the dielectric because of the sputtering technique used. Also, the electrode size is reduced because there is no need for external compensating networks with the FET operational amplifier.

**Note:**

The following documentation may be obtained from:  
National Technical Information Service  
Springfield, Virginia 22151  
Single document price \$3.00  
(or microfiche \$0.95)

Reference: NASA CR-115530 (N72-22096),  
The Development of Insulated Electrocardiogram Electrodes.

**Patent status:**

This invention is owned by NASA, and a patent application has been filed. Inquiries concerning non-exclusive or exclusive license for its commercial development should be addressed to:

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